بسم الله الرحمن الرحيم

Autonomic Nervous System

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OBJECTIVES

At the end of the lecture, students should be able to:

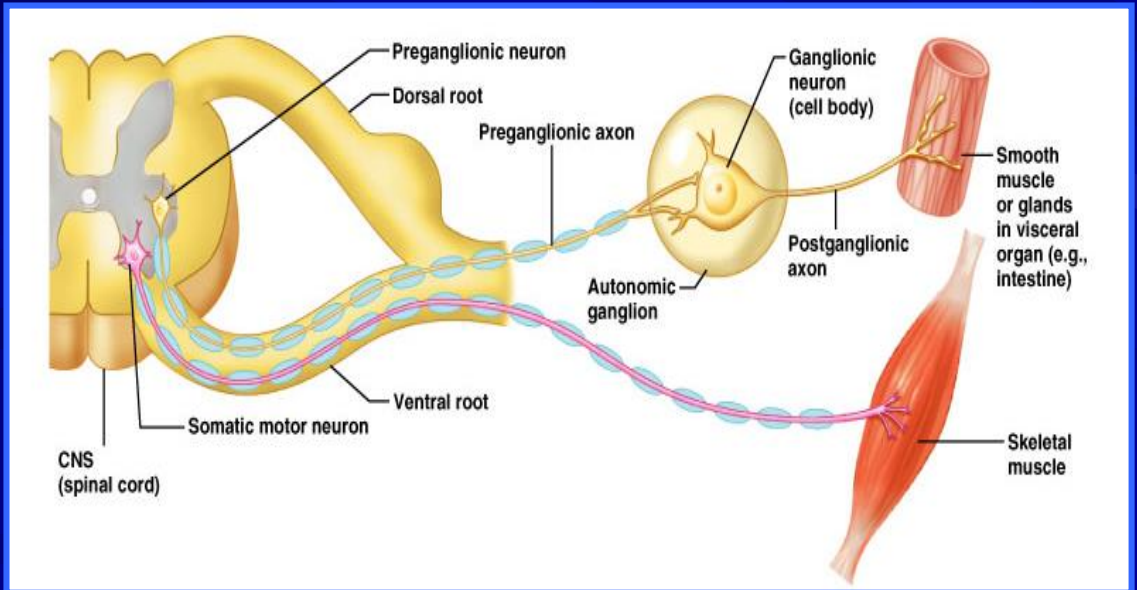
- *Define the autonomic nervous system.*
- *Describe the structure of autonomic nervous system*
- *Trace the preganglionic & postganglionic neurons in both sympathetic & parasympathetic nervous system.*
- *Enumerate in brief the main effects of sympathetic & parasympathetic system*

Autonomic Nervous System

- Concerned with the innervation and control of **Involuntary structures**: visceral organs, smooth & cardiac muscles and glands
- **Function:** maintain homeostasis of the internal environment along with the Endocrine system
- **Located:** both in the **central and peripheral nervous systems.**
- **Regulated (controlled)** by **Hypothalamus.**

Autonomic Nervous System

- Unlike the somatic nervous system, the **Efferent** pathway of the autonomic nervous system is made up of two neurons called as **preganglionic** and **postganglionic** neurons
- The cell bodies of the **preganglionic** neurons are located in the brain and spinal cord. Their axons synapse with the **postganglionic** neurons whose cell bodies are located in the autonomic ganglia



- Based on the anatomical, physiological and pharmacological characteristics, the autonomic nervous system is divided into:
  - Sympathetic: Activated during exercise, excitement, and emergencies. “fight, flight, or fright”
  - Parasympathetic: Concerned with conserving energy. “rest and digest”

14–7 This man is making good use of the sympathetic part of his autonomic us system.

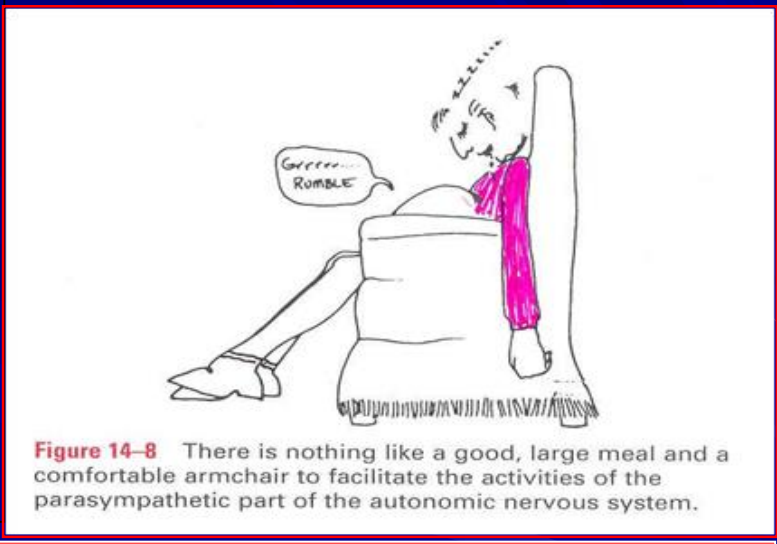
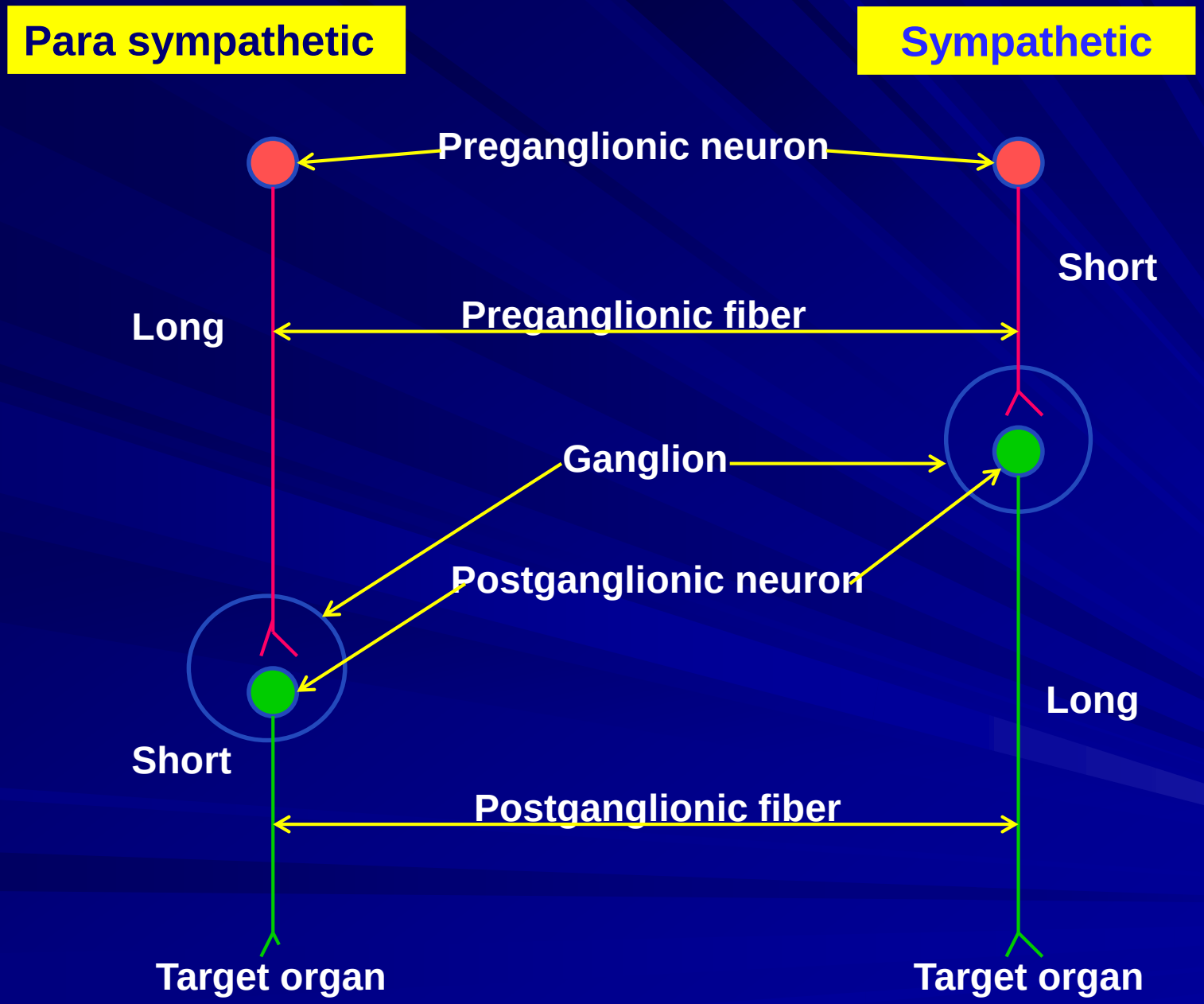


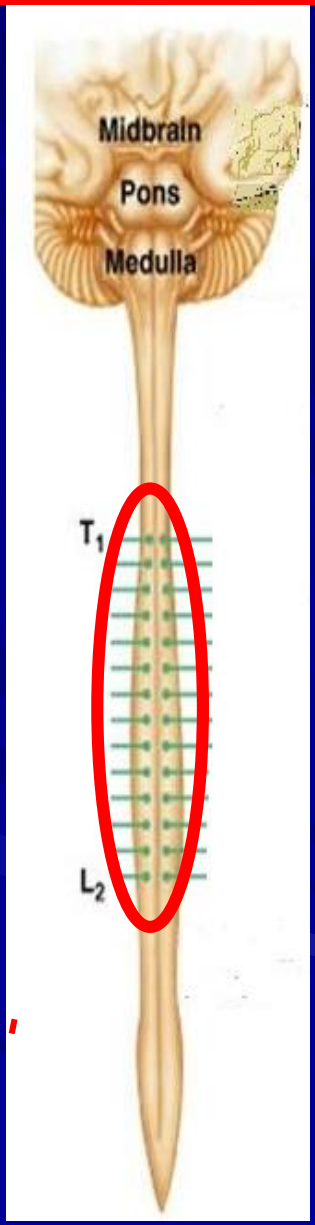
Figure 14–8 There is nothing like a good, large meal and a comfortable armchair to facilitate the activities of the parasympathetic part of the autonomic nervous system.

Both divisions operate in conjunction with one another (have antagonistic control over the viscera) to maintain a stable internal environment


Para sympathetic
Sympathetic
Preganglionic neuron
Short
Long
Preganglionic fiber
Ganglion
Postganglionic neuron
Long
Short
Postganglionic fiber
Target organ
Target organ

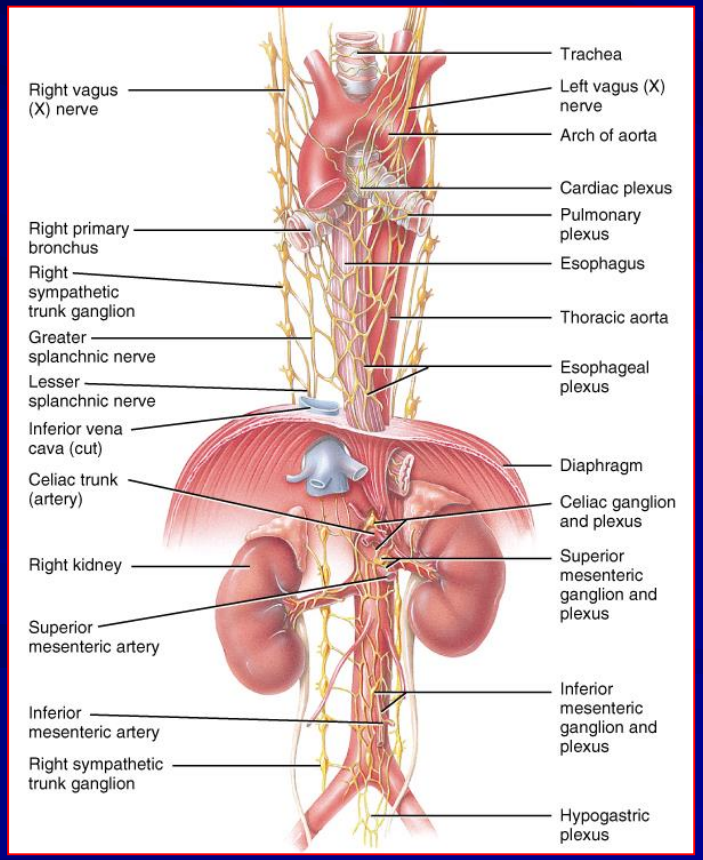
Sympathetic Division

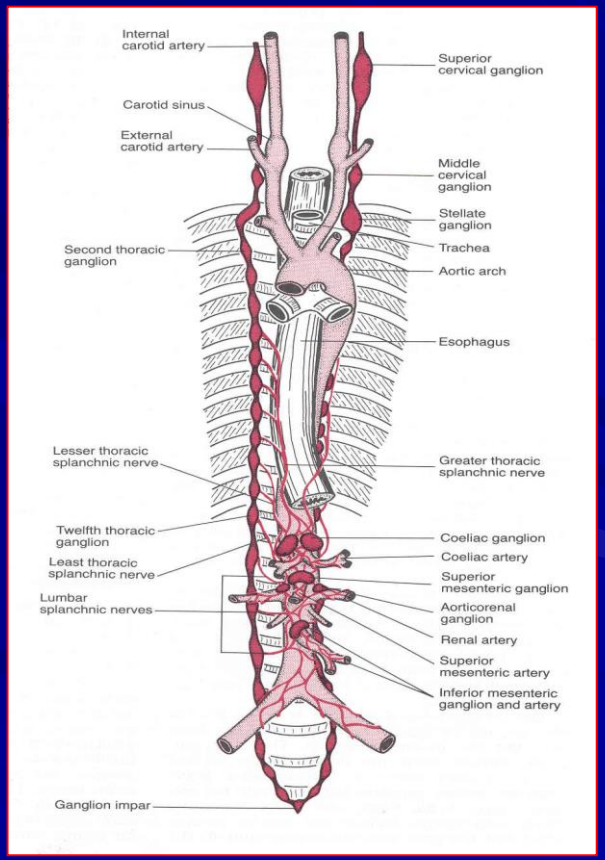
- **Preganglionic Neurons:** located in the lateral gray horn of T_1-L_2 segments of spinal cord (Thoracolumbar outflow)



Post Ganglionic Ganglia

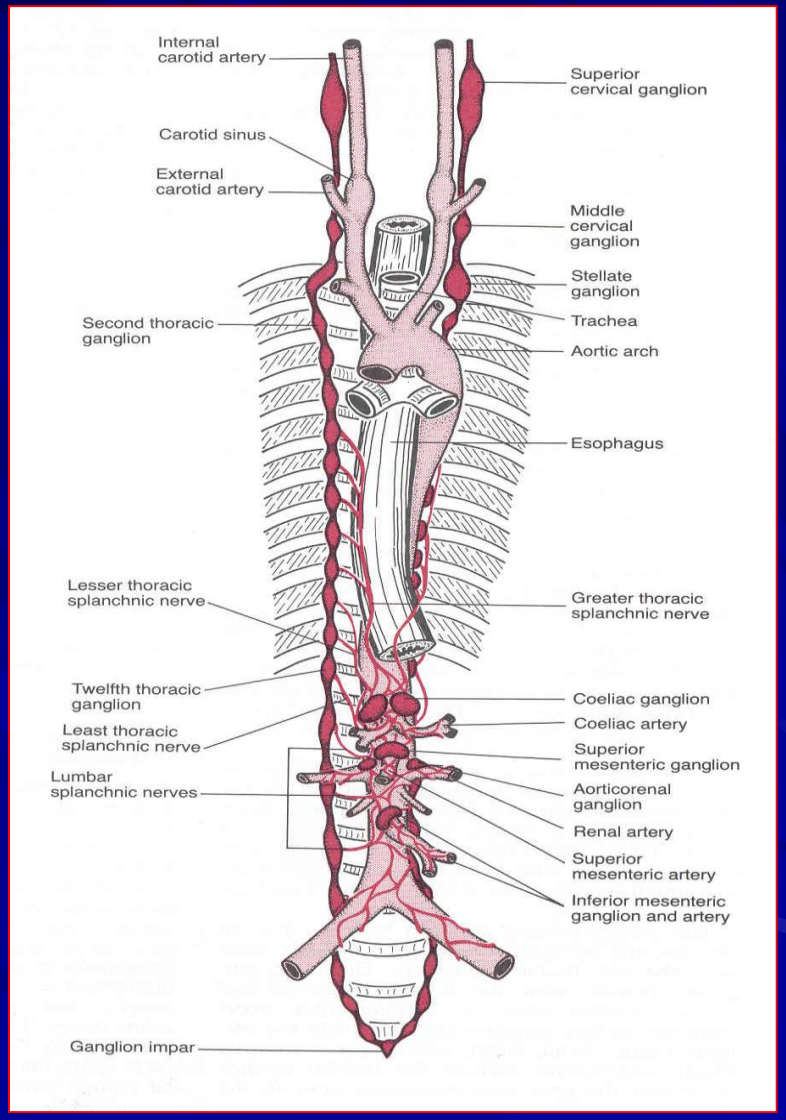
- Located nearer the central nervous system as:
  - Prevertebral: celiac & mesenteric
  - Paravertebral forming sympathetic chain





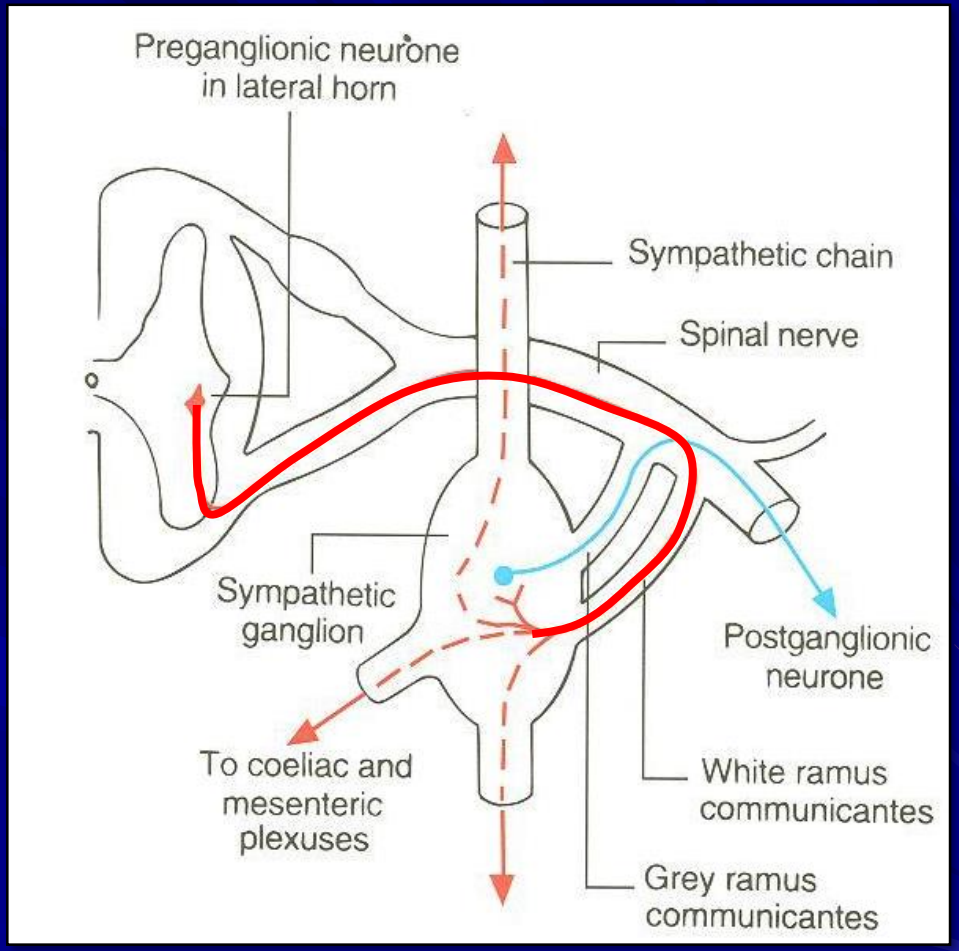
Paravertebral Ganglia

- They are interconnected to form 2 **sympathetic chains**, one on each side of vertebral column.
- Number of ganglia:
  - Three in cervical part of chain
  - Eleven to twelve in thoracic part
  - Four in lumbar & sacral parts each.
- The chains end into a common '**ganglion impar**' in front of coccyx



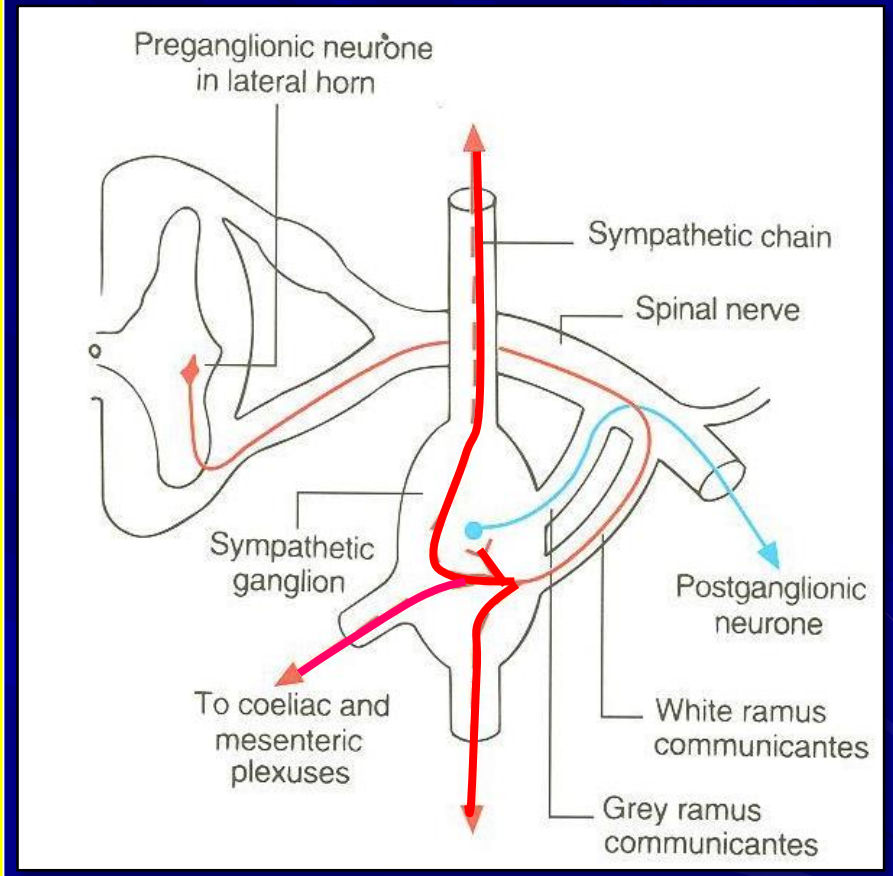
Preganglionic fibers

- Run in the ventral roots of the spinal nerve
- Travel through the spinal nerve, and then join the sympathetic chain via the White Rami Communicans. (WRC)



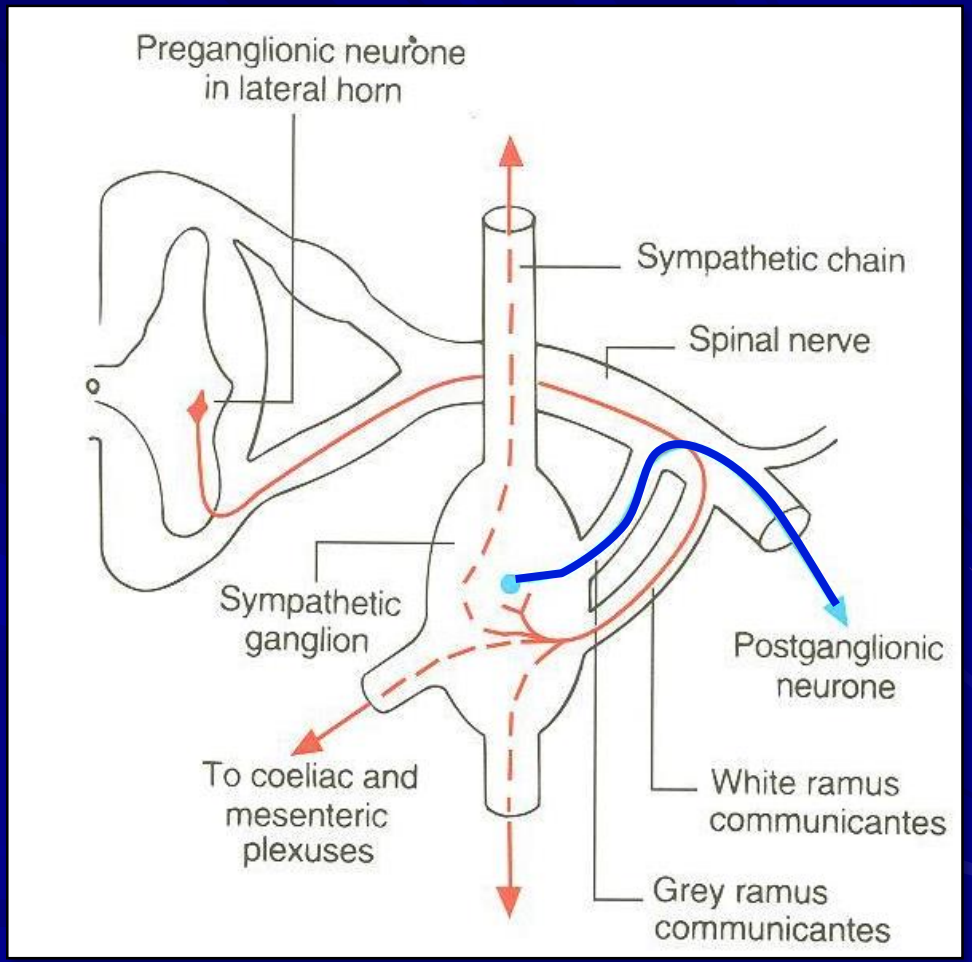
- Within the sympathetic chain, these fibers may:

1. Ascend, descend or remain at the same level to synapse with neurons (postganglionic) of **paravertebral ganglia** located in sympathetic chain.
2. Leave the sympathetic chain (without synapse) to reach **coeliac & mesenteric ganglia** (around branches of abdominal aorta) to synapse with their neurons (postganglionic).



Postganglionic fibers

- From the sympathetic chain ganglia enter again into the spinal nerve through Grey Rami Communicantes (GRC) to supply *structures in head & thorax + blood vessels & sweat glands*
- From the cells of coeliac & mesenteric ganglia supply *abdominal & pelvic viscera.*



Parasympathetic Division

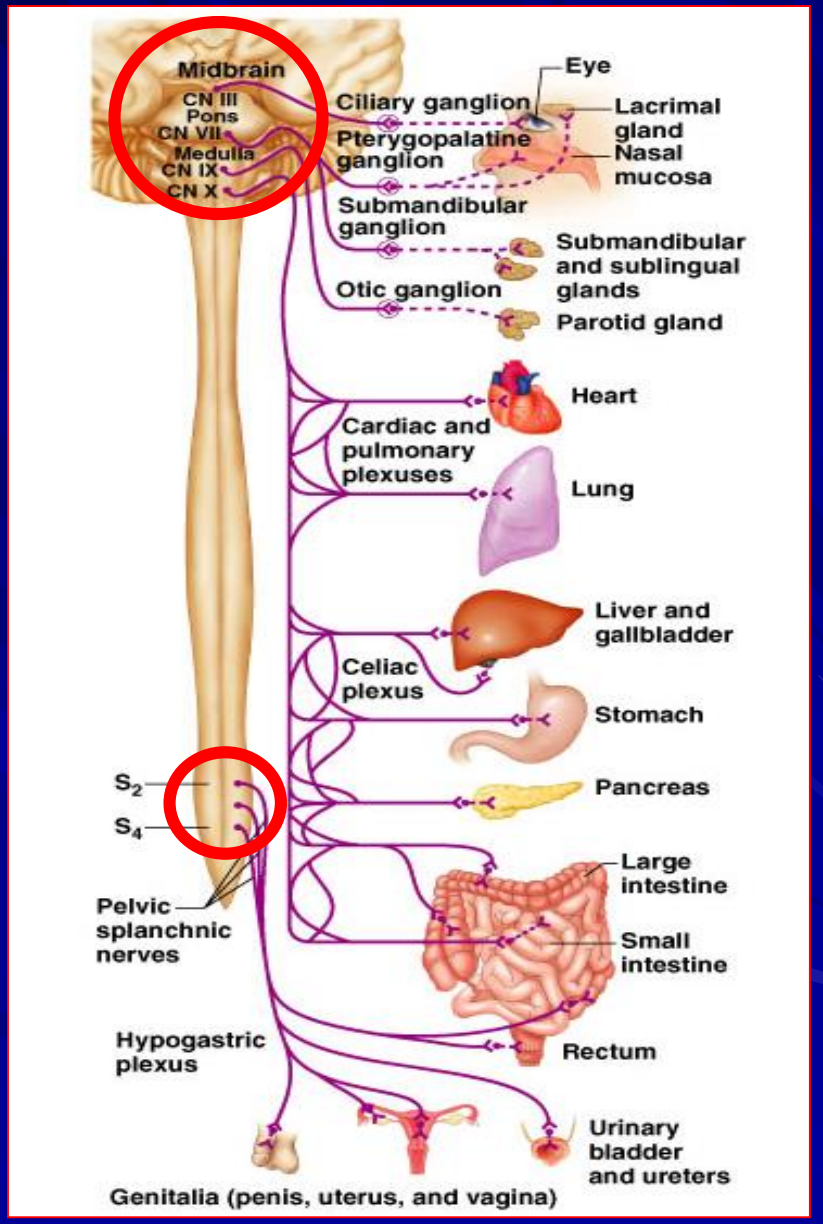
Preganglionic neurons

Located in:

- Nuclei of the 3rd, 7th, 9th & 10th cranial nerves, in the brain stem (Cranial outflow)

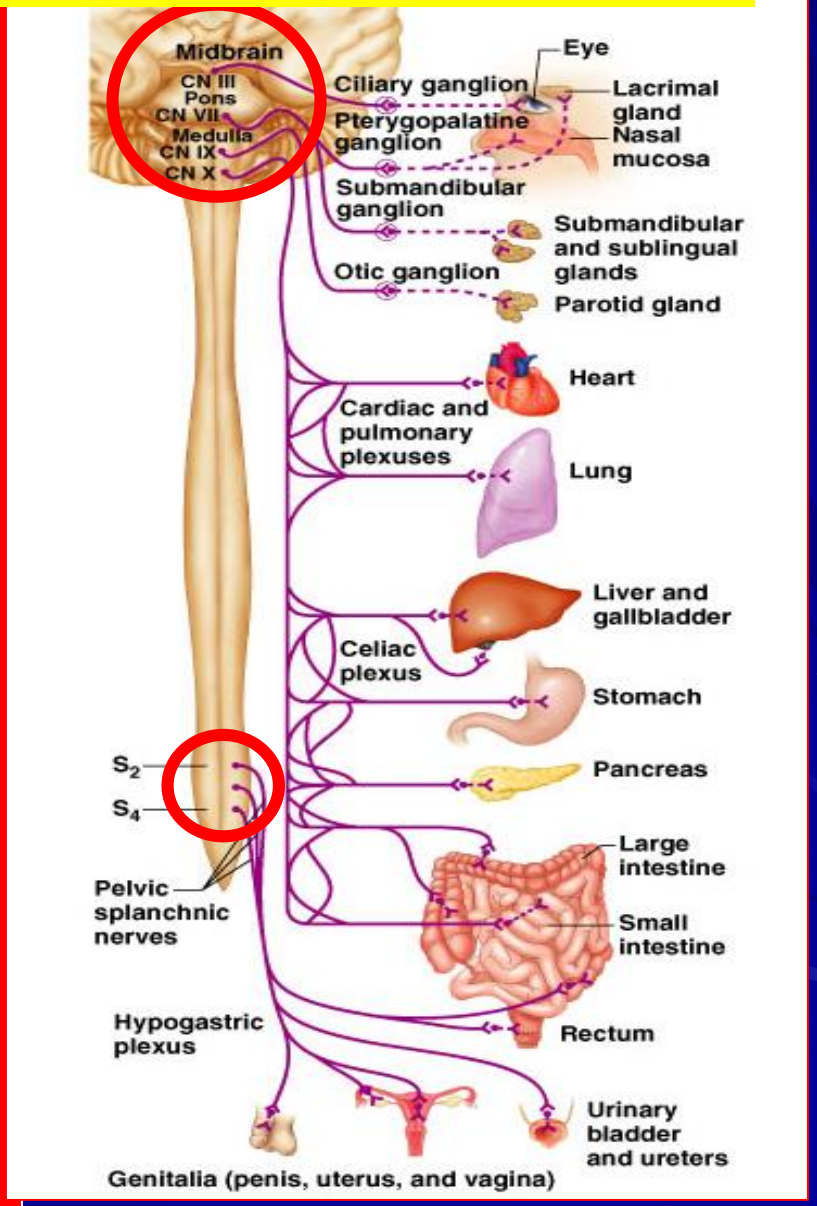
&

- The lateral gray horn of S_2-S_4 segments of spinal cord (Sacral outflow)



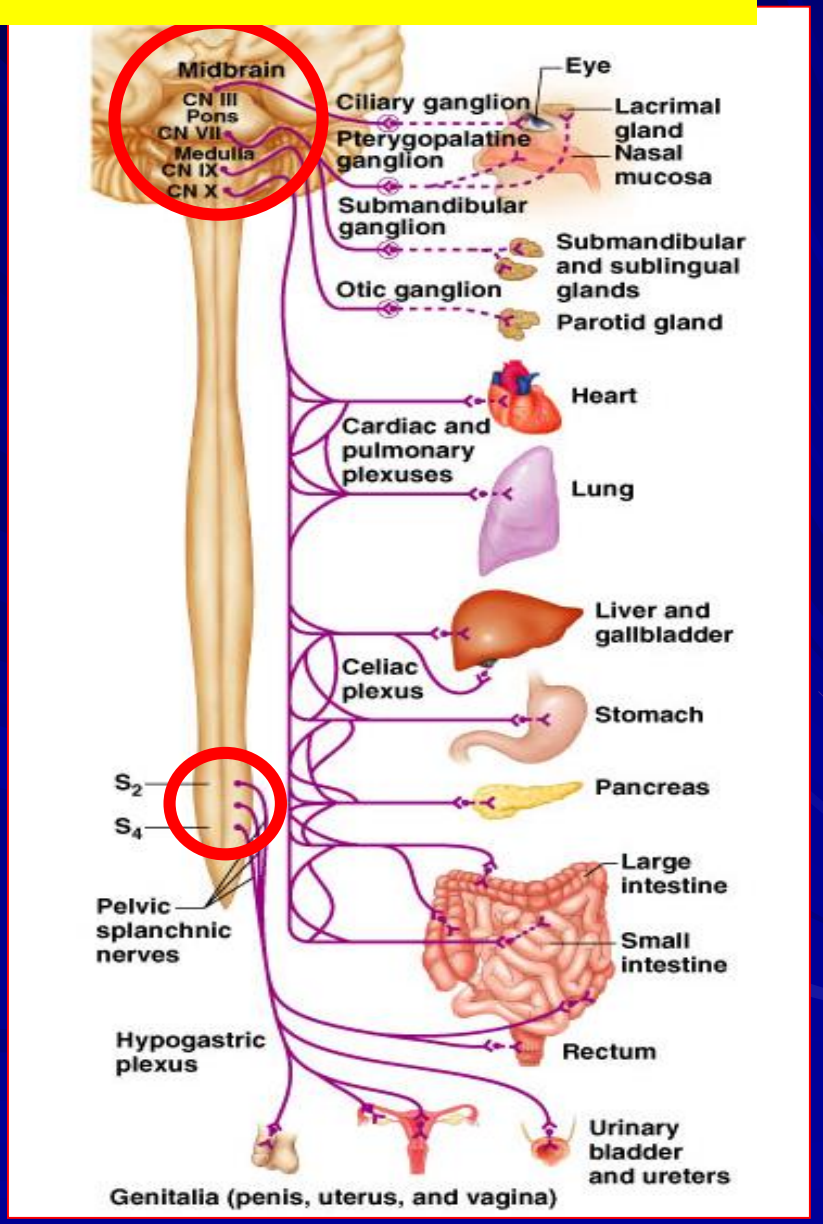
Cranial Outflow

- **Preganglionic fibers from *cranial outflow*** are carried by **3rd, 7th, 9th & 10th cranial nerves** and terminate in **ciliary, pterygopalatine, submandibular, otic & peripheral ganglia**
- **Postganglionic fibers** innervate organs of the head, neck, thorax, and abdomen



Sacral Outflow

- **Preganglionic fibers** from ***sacral outflow*** are carried by **pelvic splanchnic nerves** to peripheral ganglia in pelvis where they synapse.
- **Postganglionic fibers** innervate organs of the pelvis and lower abdomen



Autonomic nervous system

Structure	Sympathetic effect	Parasympathetic effect
Iris of eye	Dilates pupil	Constricts pupil
Ciliary muscle of eye	Relaxes	Contracts
Salivary glands	Reduces secretion	Increases secretion
Lacrimal gland	Reduces secretion	Increases secretion
Heart	Increases rate and force of contraction	Decreases rate and force of contraction
Bronchi	Dilates	Constricts
Gastrointestinal tract	Decreases motility	Increases motility
Sweat glands	Increases secretion	
Erector pili muscles	Contracts	

Thank U & Good Luck